African Invertebrates 57(1): 15–37 (2016)
doi: 10.3897/afrinvertebr.57.8459
http://africaninvertebrates.pensoft.net

RESEARCH ARTICLE

African Invertebrates
A journal of biodiversity research

Additions to the South African sea anemone (Cnidaria, Actiniaria) fauna, with expanded distributional ranges for known species

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Academic editor: *Burgert Muller* | Received 12 March 2016 | Accepted 12 March 2016 | Published 1 April 2016

http://zoobank.org/7E415182-627F-4F4E-A4F1-9140FF8126C9

Citation: Laird MC, Griffiths CL (2016) Additions to the South African sea anemone (Cnidaria, Actiniaria) fauna, with expanded distributional ranges for known species. African Invertebrates 57(1): 15–37. doi: 10.3897/afrinvertebr.57.8459

Abstract

The last monograph on South African sea anemones was published by Carlgren more than 75 years ago. Since that time, very little taxonomic research has been undertaken on this group and only seven additional species have been added to the regional fauna. In this study we document the history of taxonomic research and of species discovery for the South African anemone fauna, report on further additions to the fauna, and document expanded distributional ranges of known species. This study presents data from our own collections, as well as from the examination of historical data and museum collections, and from photographic records and specimens collected by SCUBA divers. Based on these data, two newly-discovered, but still un-described species, along with 12 new records, are added to the list of South African sea anemones. In addition, the ranges of 39 previously-known species are expanded. These new discoveries raise the total number of Actiniaria and Corallimorpharia species recognised from South African waters to 63.

Keywords

Anemone, Actiniaria, South Africa, species list

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Introduction

The first anemone record from South African waters was *Actinia capensis* in 1830, now accepted as *Bunodosoma capense* (Lesson, 1830). No further new discoveries that remain valid today were made until 1857, when *Cystiactis reynaudi*, now called *Bunodactis reynaudi*, was described from the Cape of Good Hope (Milne Edwards 1857). Verrill (1865, 1867, 1869) then described three new species, now called *Haloclava capensis*, *Corynactis annulata* and *Anthothoe stimpsonii*. This was followed by the description of *Anthopleura michaelseni* by Pax (1926) and by the addition of 10 species collected during the German deep-sea expedition on the steamer "Valdivia" two years later (Carlgren 1928a). In 1938, Carlgren made what has been the most significant contribution to South African Actiniarian systematics to date, by recording an additional 23 species from the region (Carlgren 1938) in his 'Monograph of South African Actiniaria and Corallimorpharia' and raising the total number of South African actiniaria up to 41 species.

Following Carlgren's work, more than 40 years passed without any additional species being added to the anemone fauna, after which Dunn (1981) mentioned the presence of three tropical species, *Entacmaea quadricolor*, *Heteractis magnifica* and *Stichodactyla mertensii* in South Africa and England and Robson (1984) discovered *Preactis millardae*. This was followed by reports of two alien introductions in the region - *Metridium senile* from Cape Town Harbour, Table Bay (Griffiths et al. 1996) and *Sagartia ornata* from Saldanha Bay (Acuña et al. 2004). Subsequent to this, Schama et al. (2012) found that South African representatives of the species long known as '*Actinia equina*' in fact represented an un-described, endemic species, which they named *Actinia ebhayiensis.* Finally, in the most recent addition to the fauna, Daly et al. (2012) described *Edwardsia isimangaliso* from Lake St Lucia.

Apart from these few taxonomic studies and a review of the species richness, endemicity and distribution patterns of the anemone fauna by Acuña and Griffiths (2004), no recent work has been undertaken on the South African sea anemones, resulting in an underestimation of both the richness of South African fauna and the distributional ranges of known species. In this study we contribute to the rectification of these shortcomings by collating an assortment of new data from museum collections, trawl surveys, SCUBA collected records, and our own field surveys to add both new anemone species to the South African fauna and to better document the true distributional ranges of existing species.

Material and methods

During three intensive sampling trips around South Africa, animals were gathered for examination from the east, south and west coasts. Areas mentioned in the text are displayed on a map in Figure 1.

Anemones were collected from the rocks using a specialised scraper tool, relaxed using 5 ml of menthol crystals placed into sea water, and fixed in formalin. After

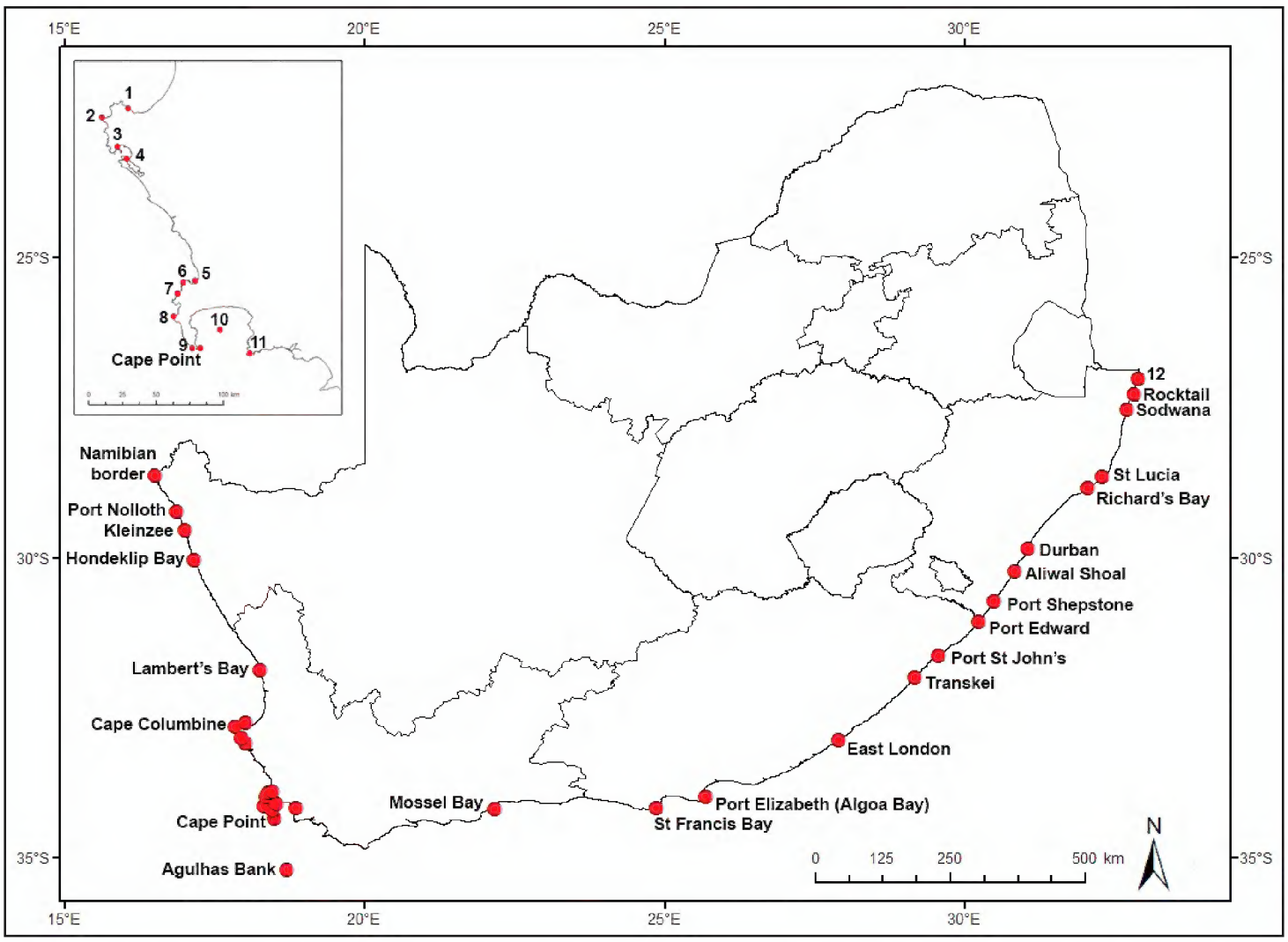

Figure 1. Map of South Africa showing places mentioned in the text: **1** St Helena Bay **2** Cape Columbine **3** Saldanha Bay **4** Langebaan Lagoon **5** Table Bay **6** Sea Point **7** Oudekraal **8** Kommetjie **9** Cape of Good Hope **10** False Bay **11** Cape Hangklip, and **12** Bhanga Nek (Mozambique border).

three days, the formalin was replaced with 70% ethanol. Two collection methods were used during these surveys: collection off rocks exposed during spring low tide and collection from up to 30 m depth by SCUBA divers. As collection permits for Sodwana Bay and Rocktail Bay were not granted for this study, due to the value of these anemones to the SCUBA diving ecotourism industry, only photographic records were obtained in these areas. Following identification of wet material, all specimens were deposited in the Iziko South African Museum (SAM) marine invertebrate collection, along with digital copies of photographs and an Excel database containing details of all records. Synonymy lists were adapted from Hexacorallians of the World (Fautin 2013).

Additional datasets from previous rocky shore intertidal surveys around South Africa were generously provided by Dr Kerry Sink and Dr Angela Mead, and photographic records provided by recreational SCUBA divers were also included where the species could be identified with confidence. Additional specimens examined for this study included previously unexamined specimens from the Iziko South African Museum (SAM) collection, which included specimens collected by the University of Cape Town (UCT) Ecological Survey and specimens collected by the Department of Agriculture, Forestry and Fisheries (DAFF) during routine deep-sea trawl surveys.

Attached to the locality data are depth records, enabling a depth range to be determined for each species. For the purposes of this study, the west coast was defined as stretching from the Namibian border to Cape Point, the south coast as stretching eastwards from Cape Point to the Mbashe River in the Transkei, and the east coast as stretching from the Mbashe River northwards to the Mozambique border.

Results

History of discovery

Figure 2 shows a timeline of the numbers of Actiniarian and Corallimorpharian species recorded from South Africa over the last two centuries. The enormous contributions made by Carlgren (1928a, 1938) are particularly striking, as is the very low level of taxonomic activity over the subsequent decades until present. Fourteen species new to South Africa were recorded during this study, including two new species currently undergoing description, making this the most significant contribution in terms of expansion of the fauna list since the monograph of Carlgren (1938). Following this study, the total number of Actiniaria and Corallimorpharia species recognised from South African waters is raised to 63.

New additions to the fauna

The samples and data sources examined resulted in the addition of 14 anemone species to the South African fauna. These comprise two species new to science, both of which are currently being formally described elsewhere, plus 12 species new to the region.

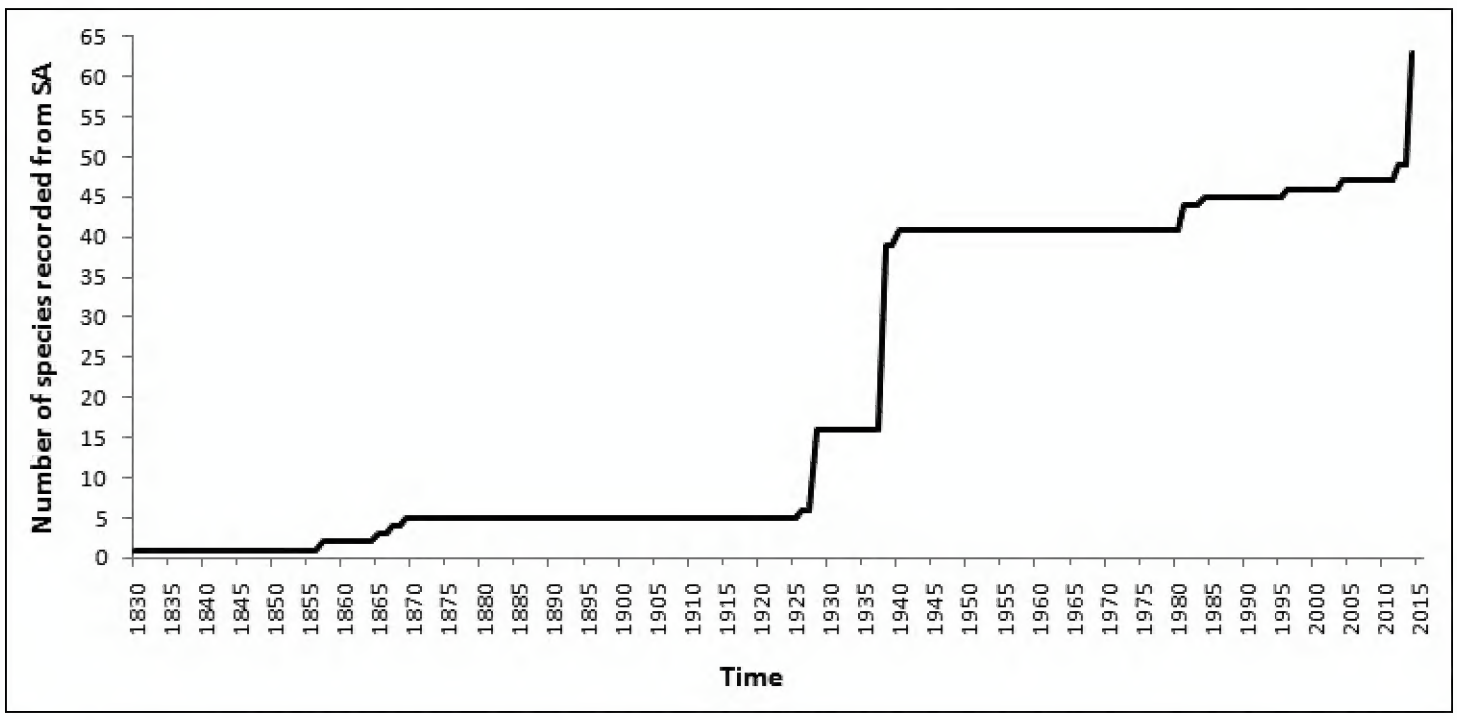

Figure 2. The number of species recorded from South Africa between 1830 and 2015.

The following account summarises the previously known range of each of these species, details where South African specimens were found, mentions similar species known from South Africa, and lists museum specimens and selected photographs of each of the new species recorded.

Table 1 summarises the specimen and photographic data for each of the new records. Five of these new records are based on photographic evidence, while specimens exist for the remaining seven.

Species new to science

Family Halcampidae Andres, 1883
Genus *Halianthella* Kwietniewski, 1896

Halianthella sp. n.
Fig. 3A

This very tiny species was discovered by Helen and Guido Zsilavecz while diving at 15 m in False Bay, near Cape Point. Specimens were sent to Dr Estefanía Rodríguez, assistant curator of the American Museum of Natural History, who is in the process of describing this material as a new species in the genus *Halianthella*. This species is thus referred to here as *Halianthella* sp. n., and it is known to SCUBA divers as the 'clown anemone'.

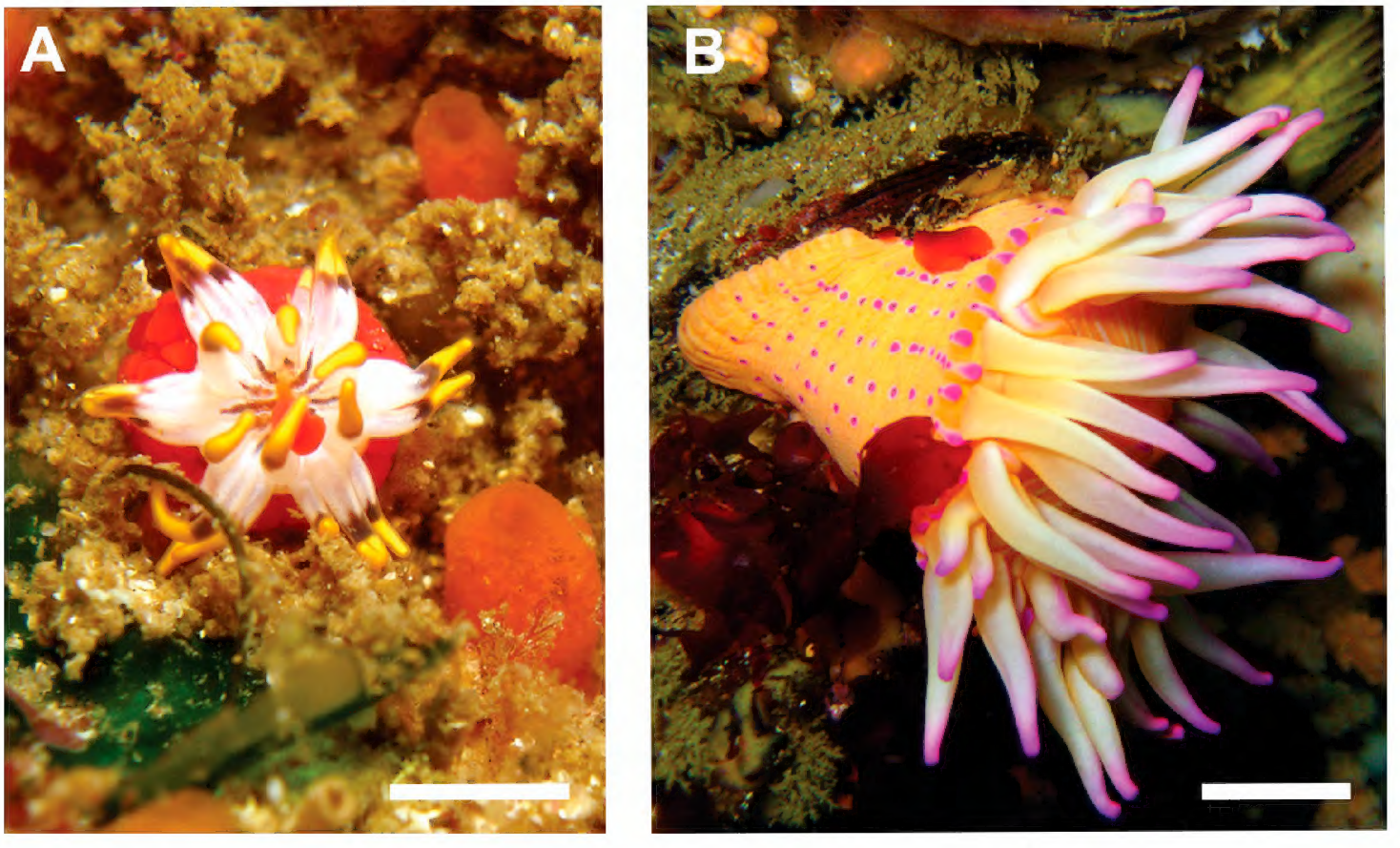

Figure 3. The two new species of sea anemone reported in this study: **A** *Halianthella* sp. n. (3 mm) and **B** *Anthostella* sp. n. (10 mm). Photographs taken by Guido Zsilavecz (**A**) and Megan Laird (**B**).

Table 1. Selected specimen and photographic records of the 12 species recorded in South Africa for the first time. Records based on photographs are only listed if no specimens are available. 'Cat #' refers to the category number of the specimen lodged in SAM, 'Station #' refers to the site where the specimens were collected and 'Photograph #' refers to the file name of the photograph lodged at SAM.

Species	Cat #	Date	Latitude	Longitude	Coast	Station #	Depth	Photograph #
Actinoscyphia plebeia	H5181	31/01/2011	31°09'44.16"S	15°37'22.68"E	West	31427	653	Actinostola capensis_Groen River_1–2
Actinoscyphia plebeia	H5179	31/01/2011	31°09'44.16"S	15°37'22.68"E	West	31427	427	
Actinoscyphia plebeia	H5178	24/01/2011	32°36'43.14"S	16°29'30.42"E	West	31399	811	Actinostola capensis_Columbine_1
Peachia parasitica	H5202	27/10/2011	33°50'11.03"S	18°25'42.52"E	West	TB01	2	Peachia parasitica_Table Bay_1–3
Peachia sp.	H5385	29/03/2002	33° 7'17.26"S	18° 3'06.57"E	West		1	
Peachia sp.			33°58'53.43"S	25°40'05.51"E	South		8	Peachia sp._Philips Reef_1
Peachia sp.			34° 2'34.89"S	25°38'30.92"E	South		18	Peachia sp._Scotsmans Reef_1-2
Pseudactinia sp.	H5588	11/03/2008	33°59'05.82"S	25°51'46.44"E	South	SAF110A	20	Pseudactinia sp. n._Riy Banks_1-5
Pseudactinia sp.	H5599	11/03/2008	33°59'04.14"S	25°51'50.46"E	South	SAF112B	17	Pseudactinia sp. n._Riy Banks_7-9
Megalactis griffithsi		28/07/2008	27° 5'53.18"S	32°50'39.91"E	East		18	Megalactis griffithsi_Pineapple Reef_1
Megalactis griffithsi		07/12/2003	27°30'38.23"S	32°42'20.54"E	East		20	Megalactis griffithsi_Sodwana Bay_1
Alicia sansibarensis	H5158	25/04/2004	27°27'30.00"S	32°43'34.80"E	East	Jago 811	105	Alicia sansibarensis_White Sands_1-2
Triactis producta		01/07/2011	30°14'60.00"S	30°49'00.00"E	East		30	Triactis producta_Aliwal Shoal_1-3
Heteractis aurora	H5401	08/04/2002	27°36'22.08"S	32°39'48.96"E	East	D12	12	
Heteractis aurora	H5467	06/10/2009	27°27'02.74"S	32°49'22.08"E	East	RR2	22	Heteractis aurora_Ribbon Reef_1-2
Heteractis crispa	H5469	05/10/2009	27°19'03.03"S	32°50'17.08"E	East	AR1	15	Heteractis crispa_Antons Reef_1-2
Heteractis malu		30/07/2008	27° 7'02.21"S	32°50'46.34"E	East		15	Heteractis malu_Aerial Reef_1-2
Heteractis malu		13/01/2004	27°30'38.23"S	32°42'20.54"E	East		20	Heteractis malu_Sodwana Bay_1
Stichodactyla haddoni		12/01/2005	27°30'10.63"S	32°42'16.62"E	East		14	Stichodactyla haddoni_Bikini Reef_1
Stichodactyla haddoni		11/05/2004	27°30'38.23"S	32°42'20.54"E	East		17	Stichodactyla haddoni_Devils Peak_1-4
Stichodactyla haddoni		14/04/2005	27°30'38.23"S	32°42'20.54"E	East		20	Stichodactyla haddoni_Sodwana Bay_1
Cryptodendrum adhaesivum			27°30'38.23"S	32°42'20.54"E	East		10	Cryptodendrum adhaesivum_Sodwana_1
Cryptodendrum adhaesivum			27°30'38.23"S	32°42'20.54"E	East		15	Cryptodendrum adhaesivum_Sodwana_2

Family Actiniidae Rafinesque, 1815
Genus *Anthostella* Carlgren, 1938

***Anthostella* sp. n.**
Fig. 3B

The second new species, known to divers as the 'dwarf spotted anemone', was first collected by Prof. Charles Griffiths from Oudekraal. This species is referred to here as *Anthostella* sp. n. as the formal publication of the description by Dr Estefanía Rodríguez and Dr Megan Laird is still pending.

Species newly reported from South Africa

Family Actinoscyphiidae Stephenson, 1920
Genus *Actinoscyphia* Stephenson, 1920

***Actinoscyphia plebeia* (McMurrich, 1893)**
Fig. 4A

Actinernus plebeius McMurrich, 1893: 165–167, pl. 24, figs 42–45; Carlgren 1896: 174; Gravier 1918: 6–7; 1922: 31–32
Actinoscyphia plebeian: Fautin 1984: 37–40; Rodríguez 2012: 215

This species is previously known from Antarctica, Chile and the South Georgia Islands off Argentina. The addition of this species to the South African fauna is based on multiple trawl records from both the west and south coasts of South Africa collected by the Department of Agriculture, Forestry and Fisheries (DAFF) during annual trawl surveys. According to available records, it was first found in 2007 on the Agulhas Bank, but those specimens remained unidentified until this study. Three specimens are lodged in the Iziko South African Museum (SAM): H5181, H5179 and H5178 (Table 1) and additional records are based on trawl data with no supporting specimens. The distribution range of this species extends from Kleinzee on the west coast to the Agulhas Bank on the south coast, between 128–866 m depth. *Actinoscyphia plebeia* is distinguishable from *Actinostola capensis*, another deep-sea species found in the same area off the coast of South Africa, by the maroon coloration of its tentacles and oral disc, its smooth column and its slimy texture.

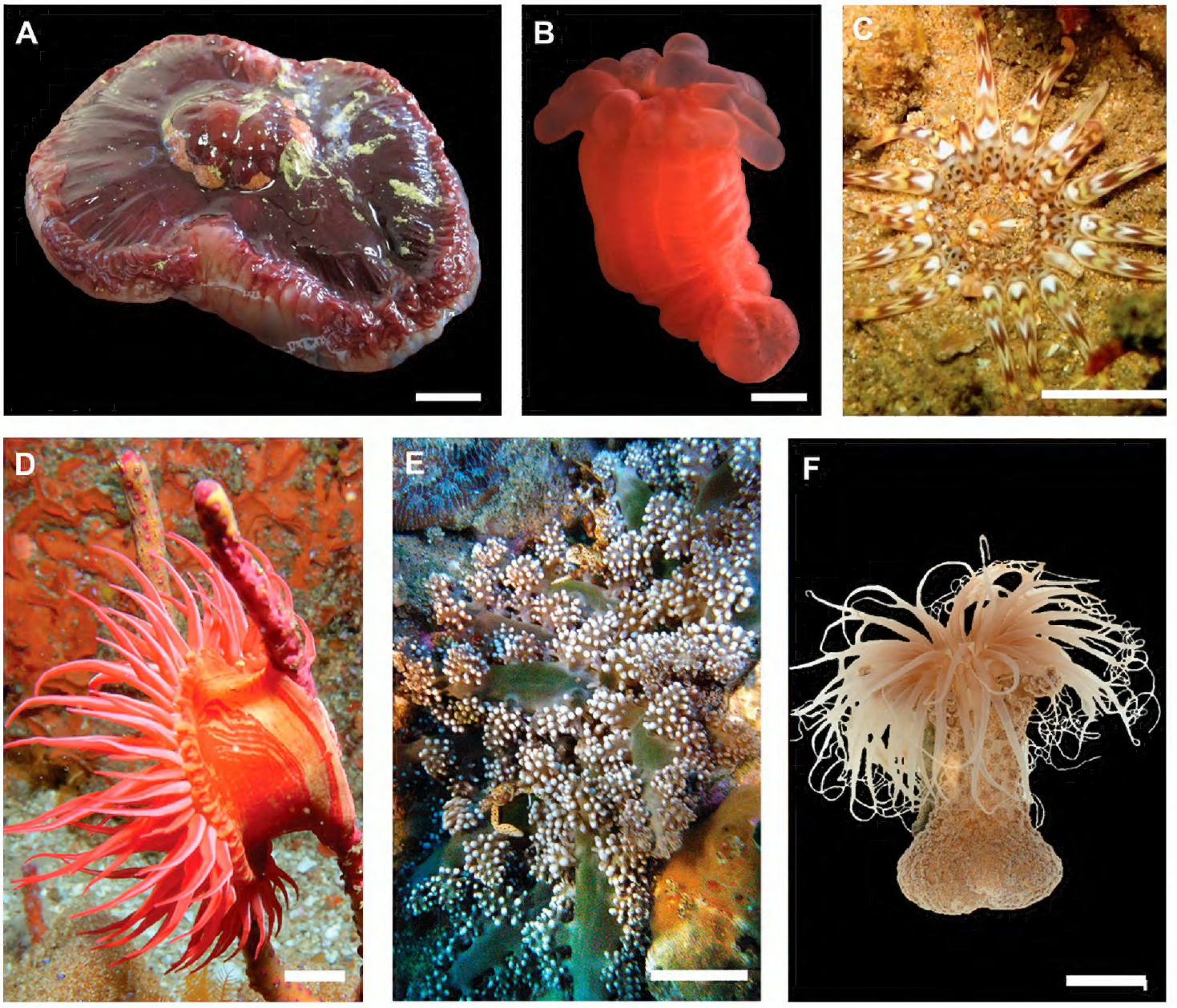

Figure 4. Six of the twelve species recorded from South Africa for the first time: **A** *Actinoscyphia plebeia* (20mm) **B** *Peachia paracitica* (2mm) **C** *Peachia* sp. (20mm) **D** *Pseudactinia* sp. (10 mm) **E** *Megalactis griffithsi* (10 mm) and **F** *Alicia sansibarensis* (20mm). Photographs taken by Dr Lara Atkinson (**A**), Dr Megan Laird (**B, E**), Andre Aggenbach (**C**), Dr Bernard Picton (**D**) and Dr Kerry Sink (**F**).

Family Haloclavidae Verrill, 1899
Genus *Peachia* Gosse, 1855

***Peachia parasitica* (Agassiz, 1859)**
Fig. 4B

Bicidium parasiticum Agassiz, 1859: 23–24
Peachia parasitica: Verrill 1866: 338–339, 343; McDermott et al. 1982: 319–321

Previously known from east and west coasts of North America, as well as from the east coast of Greenland. The addition of this species to the South African fauna is based

on a single specimen collected by Dr. Deborah Robertson-Andersson in 2011. The anemone was collected from Table Bay during a boat-based expedition targeting the collection of jellyfish. The juvenile was found attached to the underside of the medusa of the jellyfish *Chrysaora fulgida*. This specimen is lodged in SAM with catalogue number H5202 (Table 1). *Peachia parasitica* is distinguishable from *Peachia* sp. (below) by the unmarked tentacles and oral disc of the former, as well as the tendency of juveniles to live as parasites.

***Peachia* sp.**
Fig. 4C

Due to a lack of well-preserved samples, it was not possible to determine the specific name of this anemone, thus the previous range is unknown. The addition of this species to the South African fauna is based on a single specimen found in 1 m of water and collected from Langebaan Lagoon in 2002. Two additional photographic records of this species exist, both from Port Elizabeth on the south coast, between 8–18 m depth. The specimen is lodged in SAM with catalogue number H5385 (Table 1). *Peachia* sp. is distinguishable from *Peachia parasitica* by the unmistakable chevron patterns on the tentacles.

Family Actiniidae Rafinesque 1815
Genus *Pseudactinia* Carlgren, 1928b

***Pseudactinia* sp.**
Fig. 4D

As it was not possible to determine the specific name of this anemone, the previous range is unknown. The addition of this species to the South African anemone fauna is based on two specimens collected from Algoa Bay in 2008, as well as 34 photographic records from the south coast. The distributional range of this species is recorded from False Bay to Aliwal Shoal from 1–29 m depth. The two specimens are lodged in SAM: H5588 and H5599 (Table 1) and additional records are based on photographic records collected by recreational SCUBA divers. Photographic records are not listed in Table 1 and are obtainable from SAM. *Pseudactinia* sp. is large and has a very wide oral disc, like that of *P. flagellifera*, but has only one row of vesicles, while *P. flagellifera* has up to five. *Pseudactinia varia* is much smaller than *Pseudactinia* sp., but also has one row of vesicles. *Pseudactinia* sp. is unique in that the column is often mottled and the oral disc is striped. The distinction between species is not purely morphological, but is also based on molecular studies (Heestand 2009).

Family Actinodendronidae Haddon, 1898
Genus *Megalactis* Hemprich & Ehrenberg, 1834 in Ehrenberg, 1834

***Megalactis griffithsi* Saville-Kent, 1893**
Fig. 4E

Megalactis griffithsi Saville-Kent, 1893: 35, 147; Carlgren 1896: 175; 1949: 68; Haddon 1898: 399, 493–494; Stephenson 1922: 295; Uchida et al. 1975: 34–35; Fautin 1988: 25; Ardelean and Fautin 2004: 488, 491, 494, 500–501

This species is previously known from the area around Melanesia, Polynesia and Micronesia. The addition of this species to the South African fauna is based on two photographic records, one from Sodwana Bay and the other from Rocktail Bay. *Megalactis griffithsi* was first recorded in 2003 (Table 1) and is know from depths of 18–20 m. The original photograph remained unidentified until this species was again encountered during a research dive that formed part of this study in 2008. Although the specimen was not collected, it was possible to observe the behaviour of the anemone, and based on this, as well as the external morphology visible in photographs, the species name was determined. *Megalactis griffithsi* is distinguishable from *Actinodendron hansingorum* and other species of the genus by the alternating dark and light areas between each segment of the oral disc. The number of secondary branches on the tentacles also does not exceed 35 in number (Ardelean and Fautin 2004).

Family Aliciidae Duerden, 1895
Genus *Alicia* Johnson, 1861

***Alicia sansibarensis* Carlgren, 1900**
Fig. 4F

Alicia sansibarensis Carlgren, 1900: 28–30; Parulekar 1990: 219–220, 223, 225; Pax 1909: 402; Stephenson 1922: 280; Carlgren 1927*b*: 444; 1949: 43

This species was previously considered endemic to Zanzibar. The addition of this species to the South African fauna is based on one specimen from Sodwana Bay collected from 105 m depth in 2004. This specimen remained unidentified until now due to a lack of taxonomic expertise. The anemone is lodged in SAM with catalogue number H5158 (Table 1). *Alicia sansibarensis* is distinguishable from *Triactis producta*, the only other species of the family Aliciidae found in South Africa, by the division of the column of *A. sansibarensis* into a scapus and a capitulum. The tentacles of *A. sansibarensis* are very long and snake-like, while those of *T. producta* are short.

Genus *Triactis* Klunzinger, 1877

Triactis producta Klunzinger, 1877

Fig. 5A

Triactis producta Klunzinger, 1877: 85–86, pl. 6, fig. 8; Carlgren 1947: 14; 1949: 44. Fishelson 1970: 107–108, fig. 5; Fautin et al. 2008: 39–40, 51–52
Hoplophoria cincta Haddon, 1898: 398, 438–439; pl. 23, figs 11–15; Carlgren 1947: 14
Triactis cincta: Carlgren 1945: 7; 1949: 44; 1950: 427, 433

This species is previously known from across most of the Indo-Pacific. The addition of this species to the South African fauna is based on one photographic record from a 30 m dive at Aliwal Shoal in 2011 (Table 1). It was possible to determine the species of the anemone conclusively based on external morphology visible in photographs. This anemone is unique in that it possesses pseudotentacles that function to maximise photosynthesis by zooxanthellae. *Triactis producta* is distinguishable from *Alicia sansibarensis* by the presence of bifurcated stalked outgrowths protruding from mid-column.

Family Stichodactylidae Andres, 1883

Genus *Heteractis* Milne Edwards & Haime, 1851

Heteractis aurora (Quoy & Gaimard, 1833)

Fig. 5B

Actinia aurora Quoy & Gaimard, 1833: 141–142, pl. 12, fig. 1–4
Heteractis aurora: Milne Edwards 1857: 261; Carlgren 1949: 108; Dunn 1981: 39–40, 56–66, 105, 107–108; Hirose 1985: 114, 116–121, 123–125; Cutress and Arneson 1987: 54, 55, 57, 59, pl. 2, fig. 2f; England 1988: 45–54; Badsha 1991: 139–144; den Hartog 1994: 75, 77–78
Antheopsis koseirensis England, 1987: 207, 273, 276
Bunodes koseirensis: England 1988: 53

This species is previously known from across most of the Indo-Pacific. The addition of this species to the South African fauna is based two specimens from Sodwana Bay. The first specimen was found in 2002, but remained unidentified until the collection of the second specimen in 2009. Subsequently, numerous sightings have been reported between depths of 12–15 m, with one sighting at Aliwal Shoal. The two specimens are lodged in SAM: H5401 and H5467 as shown in Table 1; with six additional photographic records not listed here, but obtainable from the SAM database. *Heteractis aurora* is distinguishable from other species of the genus by the 'beaded' tentacles formed by swellings along their length.

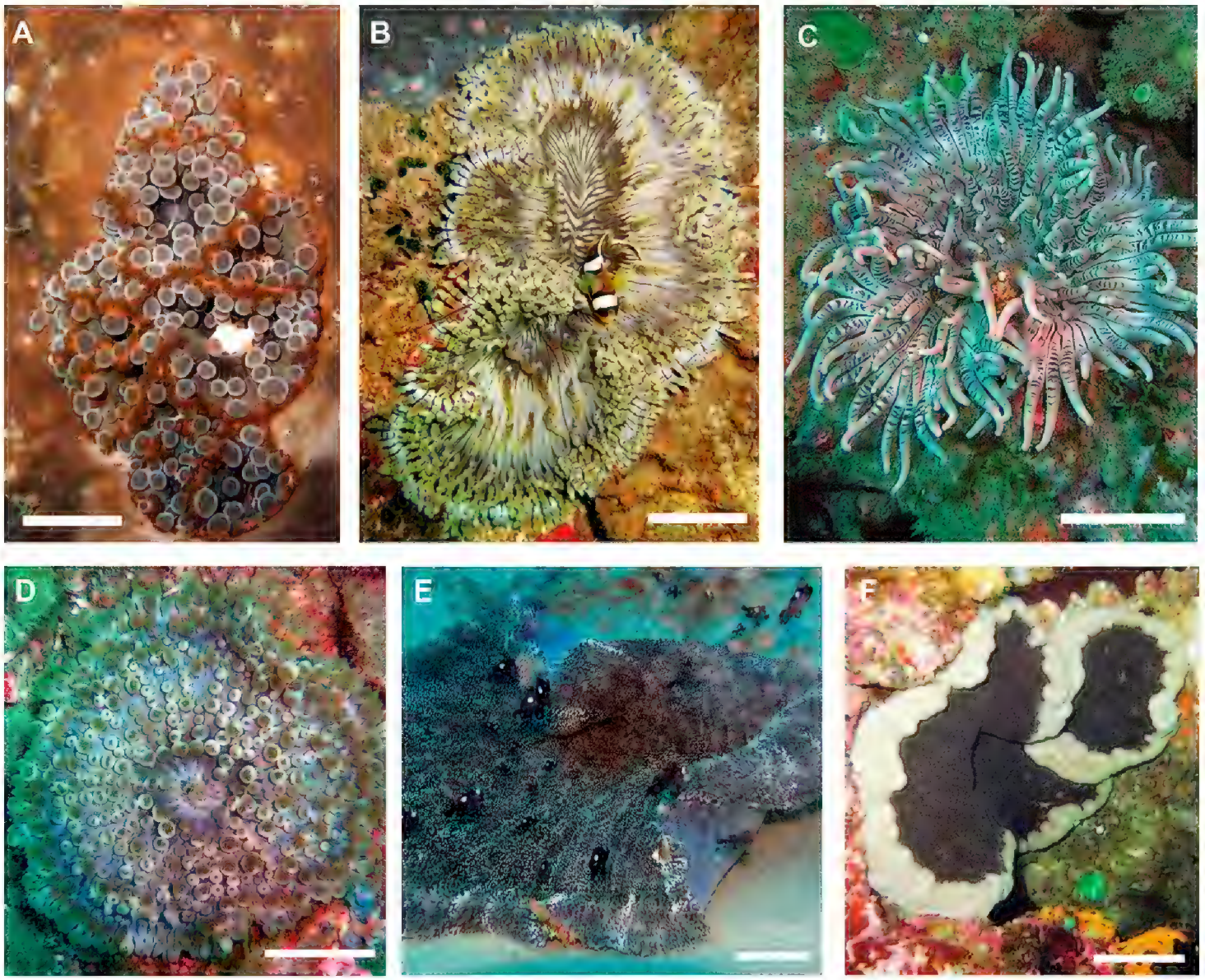

Figure 5. Six of the twelve species recorded from South Africa for the first time: **A** *Triactis producta* (30 mm) **B** *Heteractis aurora* (50 mm) **C** *Heteractis crispa* (50 mm) **D** *Heteractis malu* (40 mm) **E** *Stichodactyla haddoni* (100 mm) and **F** *Cryptodendrum adhaesivum* (150 mm). Photographs taken by Dr Megan Laird (**A–C, F**), Christo Van Jaarsveld (**D**) and Dr Kerry Sink (**E**).

Heteractis crispa (Hemprich & Ehrenberg in Ehrenberg, 1834)

Fig. 5C

Actinia Entacmaea crispa Ehrenberg, 1834: 260, pl. 8, fig. 1
Entacmaea crispa Carlgren, 1899: 14
Heteractis crispa Dunn, 1981: 47–57, 65, 71. Hirose 1985: 114, 116–125. Fautin 1986: 172–173, 179. Richardson et al. 1997: 60–65. Hattori 2006: 51–56. Scott and Harrison 2007a: 163–169; 2007b: 110–119; 2008: 833–838. Fautin et al. 2009: 121, 123, 134–135, 136, 139, 140
Heteractis macrodactylum Cutress & Arneson, 1987: 54–55, 57, 59, pl. 2, fig. 2d
Radianthus crispus Uchida & Soyama, 2001: 91, 151, 155

The range of this species extends across most of the Indo-Pacific. The addition of *Heteractis crispa* to the South African fauna is based on one specimen from Sodwana Bay found during a field survey for this study in 2009. This specimen is lodged in

SAM with catalogue number H5469 (Table 1). The seven photographic records are obtainable from the SAM database. The distributional range of this species in South Africa is from Aliwal Shoal to Rocktail Bay, between 15–22 m depth. *Heteractis crispa* is distinguishable from other species of the genus by the frosted stripes on each tentacle and the thick, leathery column.

***Heteractis malu* (Haddon & Shackleton, 1893)**
Fig. 5D

Discosoma Malu Haddon & Shackleton, 1893: 117, 120
Heteractis malu Dunn, 1981: 35, 40, 47, 57, 66–71, 104, 107–108
Radianthus malu England, 1988: 53

This species is previously known from across most of the Indo-Pacific. The addition of *Heteractis malu* to the South African fauna is based on two photographic records from Sodwana Bay from 15–20 m, with the first taken by a SCUBA diver in 2004 (Table 1). The species was encountered again during a field survey for this study in 2008. Although the anemone was not collected, it was possible to conclusively determine the species based on external morphology visible in photographs. They show adhesive verrucae on the column, as well as short, sparse tentacles (Fautin et al. 2008).

Genus *Stichodactyla* Brandt, 1835

***Stichodactyla haddoni* (Saville-Kent, 1893)**
Fig. 5E

Discosoma Haddoni Saville-Kent, 1893: 32–33. Carlgren 1896: 174
Stichodactyla haddoni Dunn, 1981: 82–91. Fautin and Allen 1992: 40–41. Fautin et al. 2009: 133

The range of this species extends across most of the Indo-Pacific. The addition of *Stichodactyla haddoni* to the South African fauna is based on three photographic records from Sodwana Bay in 14–20 m of water. The anemone was first recorded by a SCUBA diver in 2004, with two additional photographs taken in 2005 (Table 1). No South African specimens of this anemone are housed in SAM; however, a specimen from just north of the Mozambique border is in the museum collection. As this is a large anemone, it was possible to determine the species based on external morphology visible in photographs. *Stichodactyla haddoni* is usually easily distinguishable from *S. mertensii,* as *S. haddoni* is usually found in sand, has a weakly adherent pedal disc, has extremely sticky tentacles, has a column that is unable to contract completely, and has a maximum oral disc diameter of 500 mm. In contrast, *S. mertensii* is found attached

to coral reef, has an extremely adhesive pedal disc, has non-adherent tentacles, is able to slowly contract into crevices (Fautin and Allen 1997) and has a maximum oral disc diameter of 1500 mm.

Family Thalassianthidae Milne Edwards, 1857
Genus *Cryptodendrum* Klunzinger, 1877

***Cryptodendrum adhaesivum* Klunzinger, 1877**
Figure 5F

Cryptodendrum adhäsivum Klunzinger, 1877: 86
Cryptodendrum adhaesivum Haddon, 1898: 399, 483–484, pl. 25, figs 4–6, pl. 32, figs 5–6. Carlgren 1940b: 7, 32–34, figs 9,13; 1949: 70. Dunn 1981: 7–13. Cutress and Arneson 1987: 54, 55, 57, 59, pl. 2, fig. 2c. Richardson et al. 1997: 61–62, 64. Fautin 2009: 131–132, 140, fig. 11

This species is previously known from across most of the Indo-Pacific. The addition of this species to the South African fauna is based on two photographic records taken between 10–15 m at Sodwana Bay during SCUBA diving surveys for this study (Table 1). As this is a large anemone, it was possible to determine the species based on external morphology visible in photographs. *C. adhaesivum* is unlike other South African anemones, as it has two forms of tentacles: inner tentacles each with five branches at tip, and outer tentacles with a single bulb at tip (Fautin and Allen 1997).

Range expansion

Since the work of Carlgren (1938) and the distributional review by Acuña and Griffiths (2004), a large amount of distributional data for anemones has been collected. These data have been stored in museums and on online databases such as 'Hexacorallians of the world' (Fautin 2013), but these ranges have never before been collated and published.

The range expansion of *Metridium senile* is the most notable, as this is one of two alien anemone species known in South Africa. This species was first recorded in South Africa from the Table Bay Harbour (Griffiths et al. 1996) in September 1995, when a well-established colony was discovered. Anemones were attached to artificial substrata, such as car tyres, at a depth of 10–16 m, and it is thought that the species was introduced to South Africa via shipping from Europe (Griffiths et al. 1996). However, in February 2006, another population of *M. senile* was discovered at 115 m on the PetroSA pipeline on the Agulhas Bank (35°13'59.08"S, 21°29'53.44"E) by Dr Lara Atkinson. Individuals were morphologically identical to those of the Table Bay population and it was interesting to note that both populations were established on artificial

structures. The size of each of these alien populations should be monitored annually to ensure that their range does not expand.

Other species for which range expansions have been detected since the work of Carlgren (1938) and Acuña and Griffiths (2004) are listed in Table 2. The distribution ranges of eight species were extended to the west, 18 species to the east, and 13 species to both the west and the east (Table 2). The fact that the ranges of so many species have been expanded, suggests that sea anemones around the South African coastline have been severely under-sampled in the past.

Discussion and conclusions

Since the writings of Carlgren (1927a, 1928a, 1938, 1940a, 1949), very little South African work has been done on the taxonomy of this group. The most recent species list available is that compiled by Acuña and Griffiths (2004), who reported 49 species of sea anemones from South Africa. Following extensive fieldwork and examination of unidentified anemones in the Iziko South African Museum (SAM) during the course of this study, the number of sea anemone species know from South Africa is hereby increased to 63. This number is high in comparison to the 30 species reported from the Faroe Islands (Fautin et al. 2005) and the 26 species from Galicia in north-western Spain (den Hartog and Ates 2011), but is on a par with the 63 species recorded from Chile (Häussermann 2006). The South African sea anemone fauna makes up over 5% of the total anemone species worldwide when compared to the species list published by Daly et al. (2007). An increase of 14 species in one country over a relatively short study suggests that many more anemone species are still to be found in South Africa. The ranges of 79% of the anemone species reported by Acuña and Griffiths (2004) were also expanded by this study. Gaps in sample coverage remain particularly obvious in deep-sea areas, particularly the bathyal (500–3500 m) and the abyssal (3500–5000 m), the latter being essentially completely unexplored. Geographically, the west and east coasts need to be more thoroughly sampled, while estuarine habitats also need to be made a priority.

Eight of the 14 species added to the fauna were found on the east coast, with seven discovered by SCUBA divers and one collected in a trawl. Two of the new additions were found on the west coast, one a shallow water species found burrowing in sand and the other a pelagic species found on the medusa of a jellyfish. Two of the new records were found on the south coast by SCUBA divers, and a further two species were found to inhabit areas extending from the west to the south coast, with one found by SCUBA divers and the other retrieved by a deep-sea trawl. All of the east coast records are tropical forms previously well known from the Indo-Pacific. The use of SCUBA divers as a collection method for sea anemones has resulted in the addition of 10 of the 14 new records. This method was not available to Carlgren, which probably explains why these species were missed by him. As they occur at depths of 2 m and deeper, they are beyond the reach of rocky shore researchers, while at the same time being too shallow, or occurring in reef

Table 2. Previous distribution and depth ranges and updated distribution and depth ranges for each anemone species that experienced an alteration in range. References for previous records are listed. Species range expansions were classified as being to the west (W), the east (E) or to both the west and east (W&E). A dash (-) indicates species that were found to have increased depth ranges. See Figure 1 for site locations.

Species	Previous records		Updated records		Exp.	Reference
	Location	Depth	Location	Depth		
Acontiophorum mortenseni	Agulhas Bank	73–76	Hondeklip Bay to Transkei	73–775	W&E	Carlgren 1938
Actinauge granulata	Cape Point to Agulhas Bank	64–500	Port Nolloth to Agulhas Bank	64–657	W	Carlgren 1938
Actinia ebhayiensis	Port Nolloth to Durban	0	Port Nolloth to Durban	0–10	-	Carlgren 1938
Actinostola capensis	Table Bay to East London	168–500	Port Nolloth to Port Shepstone	81–100	W&E	Carlgren 1938, Acuña and Griffiths 2004
Aiptasia parva	East London	?	East London to Sodwana Bay	1–45	E	Carlgren 1938
Amphianthus capensis	Agulhas Bank	155	Port Nolloth to Sodwana Bay	12–623	W&E	Carlgren 1938
Amphianthus laevis	Sea Point	?	Hondeklip Bay to Port Elizabeth	36–457	W&E	Carlgren 1938
Amphianthus natalensis	Durban	804	Agulhas Bank to Sodwana Bay	1–804	W&E	Carlgren 1938
Anemonia natalensis	Durban to Cape Vidal	0–2	Durban to Sodwana Bay	0–2	E	Carlgren 1938, Acuña and Griffiths 2004
Anthopleura anneae	Durban	0	Langebaan Lagoon to St Lucia	0–15	W&E	Carlgren 1940a
Anthopleura insignis	Kleinmond to Port St John's	0	Table Bay to Durban	0–29	W&E	Carlgren 1940a
Anthopleura michaelseni	Port Nolloth to Durban	0	Port Nolloth to Bhanga Nek	0–36	E	Carlgren 1938
Anthosactis capensis	Elands Bay to Cape Point	287	Hondeklip Bay to Sodwana Bay	12–498	W&E	Carlgren 1938, Acuña and Griffiths 2004
Anthostella stephensoni	Port Nolloth to Qolora	0	Port Nolloth to St Lucia	0–42	E	Carlgren 1938, Acuña and Griffiths 2004
Anthothoe stimpsonii	Port Nolloth to Durban	0–76	Port Nolloth to Durban	0–120	-	Carlgren 1938
Bolocera kerguelensis	Table Bay to East London	73–325	Port Nolloth to East London	16–750	W	Carlgren 1938, Acuña and Griffiths 2004
Bunodactis reynaudi	Port Nolloth to Durban	0	Port Nolloth to St Lucia	0–30	E	Carlgren 1938
Bunodosoma capense	Saldanha to Durban	0–27	Port Nolloth to Durban	0–100	W	Carlgren 1938, Acuña and Griffiths 2004
Calliactis algoaensis	Port Elizabeth	91	Port Elizabeth to Sodwana Bay	66–850	E	Carlgren 1938
Calliactis polypus	Durban to Mozambique	?	False Bay to Mozambique	2–201	W	Carlgren 1938, Acuña and Griffiths 2004
Condylanthus magellanicus	Cape Point to Agulhas Bank	73–500	Cape Point to Agulhas Bank	73–500	-	Carlgren 1938
Corynactis annulata	Port Nolloth to Mossel Bay	0–73	Port Nolloth to East London	0–108	E	Carlgren 1938, Acuña and Griffiths 2004
Edwardsia capensis	False Bay	91	False Bay to Sodwana Bay	0–91	E	Carlgren 1938
Entacmaea quadricolor	Aliwal Shoal to Durban	?	Aliwal Shoal to Sodwana Bay	14–18	E	Acuña and Griffiths 2004
Gyractis sesere	Port Edward to Durban	0	Port Edward to Sodwana Bay	0–20	E	Carlgren 1938, Acuña and Griffiths 2004

Species	Previous records		Updated records		Exp.	Reference
	Location	Depth	Location	Depth		
Halcampa capensis	False Bay	91	St Helena Bay & False Bay	12–91	W	Carlgren 1938
Halcampaster teres	East London	0–3	Sea Point to East London	0–11	W	Carlgren 1938
Halcurias capensis	Cape Town and Agulhas Bank	100–287	Cape Town to Cape Agulhas	25–349	E	Carlgren 1938, Acuña and Griffiths 2004
Halianthella annularis	Lamberts Bay to Kommetjie	0	Lamberts Bay to Richard's Bay	0–79	E	Carlgren 1938, Acuña and Griffiths 2004
Haloclava capensis	False Bay	21	Lambert's Bay to Port St John's	0–170	W&E	Carlgren 1938
Heteractis magnifica	Durban	?	Durban to Rocktail Bay	14–25	E	Acuña and Griffiths 2004
Isanthus capensis	Lamberts Bay to Cape Hangklip	0	Hondeklip Bay to Cape Hangklip	0–157	W	Carlgren 1938, Acuña and Griffiths 2004
Isophellia algoaensis	Port Elizabeth	40	Hondeklip Bay to East London	15–1240	W&E	Carlgren 1938
Korsaranthus natalensis	False Bay to Durban	?	False Bay to Durban	0–32	-	Carlgren 1938, Acuña and Griffiths 2004
Liponema multiporum	Agulhas Bank	500	Hondeklip Bay to St Francis Bay	110–500	W&E	Carlgren 1938
Litophellia octoradiata	Durban	0	Durban	0	-	Carlgren 1938
Metridium senile	Table Bay	6–12	Table Bay & Mossel Bay	9–122	E	Griffiths et al. 1996, Acuña and Griffiths 2004
Phellia aucklandica	Oudekraal	0–1	Oudekraal	0–1	-	Carlgren 1938
Phelliactis algoaensis	Port Elizabeth	40	Cape Point & Port Elizabeth	40	W	Carlgren 1938
Phelliactis capensis	Cape Point	566–1024	Cape Point to St Lucia	560–1204	E	Carlgren 1938
Preactis millardae	Table Bay to False Bay	10 - 20	Table Bay to False Bay	0–32	-	England and Robson 1984
Pseudactinia flagellifera	Port Nolloth to Durban	0–45	Port Nolloth to St Lucia	0–102	E	Carlgren 1938
Pseudactinia varia	Oudekraal to East London	0–76	Cape Columbine to Durban	0–102	W&E	Carlgren 1938
Rhodactis rhodostoma	Durban	0	Durban to Sodwana Bay	0–20	E	Carlgren 1938
Sagartia ornata	Langebaan Lagoon	0	Langebaan & Saldanha Bay	0–56	-	Acuña et al. 2004, Acuña and Griffiths 2004
Stichodactyla mertensii	Durban	?	Durban to Sodwana Bay	15–20	E	Acuña and Griffiths 2004
Telmatactis natalensis	Durban	0–1	Durban	0–1	-	Carlgren 1938
Urticinopsis crassa	Cape Point	566–1024	Hondeklip Bay to Agulhas Bank	143–1024	W&E	Carlgren 1938

habitats that could not be sampled using ship-borne equipment such as grabs, dredges and trawl nets. This emphasises the importance of recreational SCUBA divers in the discovery of new species within this and other groups that are abundant on shallow rocky reefs.

Acknowledgements

Thanks to the Department of Agriculture, Forestry and Fisheries (DAFF) for access to their invaluable trawl dataset and the Iziko South African Museum for access to historical records. Access was granted by the iSimangaliso Wetland Park, SANParks and Cape Nature to conduct fieldwork in their respective reserves. Specimen collection was carried out with a research collecting permit issued to Prof. Charles Griffiths jointly by DAFF and the Department of Environmental Affairs (DEA). This research was funded by a National Research Foundation (NRF) grant to Prof. Charles Griffiths, a South African National Biodiversity Institute (SANBI) scholarship awarded to Megan Laird, as well as a number of University of Cape Town bursaries.

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